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EXAMINER

KIM, DAVID S

ART UNIT	PAPER NUMBER
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2633

DATE MAILED: 09/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/765,014

Applicant(s)

AGAZZI, OSCAR E.

Examiner

David S. Kim

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 June 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-80 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-80 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 June 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☒ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>6 and 9</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Oath/Declaration

1. The oath or declaration is defective. A new oath or declaration (or application data sheet) in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01, 602.02, and 603.

The oath or declaration is defective because:

The declaration indicates that the filing date of this application is 17 January 2000 (Paper No. 3, declaration, p. 1). However, the correct filing date is 17 January 2001.

Drawings

2. The drawings are objected to because of a large number of minor informalities. Some of these informalities are listed below:

- Figures 4 and 4a should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g).
- In Fig. 3, data source 202 is missing. See p. 5-6, bridging paragraph.
- In Figs. 1 and 5, reference character 111 is used to refer to two different objects.
- In Figs. 1 and 5, reference character 113 is used to refer to two different objects.
- In Figs. 1 and 5, reference character 115 is used to refer to two different objects.
- In Fig. 6, reference character 609 is used to refer to two different objects. See p. 12, l. 14-15.

Careful review of the drawings is strongly encouraged to correct these and the remaining unlisted informalities.

3. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the following limitations must be shown or the feature(s) canceled from the claim(s):

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- (claims 3, 10, 14, 21, 34, and 67) equalizing *analog* symbols; applying an inverse characterization of the channel to *analog* symbols; using an inverse characterization of the channel to modify *analog* symbols; an *analog* signal equalizer.
- (claims 6, 12, and 17) wherein D/A converting *includes/further comprises* mapping/accepting digital multilevel symbols into the subset mapper (In Fig. 3, note that the D/A converting does *not* include/further comprise the mapper).
- (claims 25, 47, and 79) equalizing the digital signal *prior to* decoding the digital signal in the trellis decoder; an equalizer...for producing an equalized signal *for coupling into* the trellis decoder (In Fig. 6, note that the equalizing takes place *inside* the trellis decoder, *not prior to it*; note that the equalizer and the trellis decoder are part of the same component, so that the equalized signal is *coupled out of* the trellis decoder).

No new matter should be entered.

4. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant

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will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

5. **Claims 1, 11, 16, 20-21, 28, and 56-57** objected to because of the following informalities:

In claim 1, l. 5-6, “analog multilevel signals” is used where – analog multilevel symbols – may be intended. Otherwise antecedent basis for the “analog multilevel symbols” is lacking.

In claim 11, l. 8, “*the* analog multilevel signal” is lacking antecedent basis (emphasis Examiner’s).

In claims 16 and 20-21, l. 1, “claim 12” is used where – claim 13 – may be intended. Otherwise, antecedent basis for the “equalizing” may be lacking.

In claims 28 and 56, the limitation “accepting data from the optical channel” appears to be missing a semi-colon at the end of the limitation.

In claim 57, l. 8, “the *digital* data” is lacking antecedent basis (emphasis Examiner’s).

Appropriate correction is required.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

7. **Claims 3, 10, 14, 21, 34, and 67** are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

In particular, note that these claims include the limitation of:

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equalizing *analog* symbols; applying an inverse characterization of the channel to *analog* symbols; using an inverse characterization of the channel to modify *analog* symbols; an *analog* signal equalizer.

While the application discusses the equalization of *electrical* symbols and signals (Figs. 2-4a), the application provides little to no discussion on the equalization of *analog* symbols and signals. Accordingly, it is unclear how the application enables one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention with this limitation without undue experimentation.

8. **Claims 6, 12, and 17** are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

In particular, note that these claims include the limitation of:

wherein D/A converting *includes/further comprises* mapping/accepting digital multilevel symbols into the subset mapper.

However, in Fig. 3, note that the D/A converting does *not* include/further comprise the mapper. Additionally, it appears that the subset mapper of Fig. 3 does *not* map/accept digital *symbols*; rather, it appears to map/accept input *bits* into output symbols (Applicant's specification, p. 5-6, bridging paragraph). Accordingly, it is unclear how the application enables one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention with this limitation without undue experimentation.

9. **Claims 25, 47, and 79** are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for:

equalizing the digital signal in the trellis decoder; an equalizer...for producing a digital equalized signal,

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does not reasonably provide enablement for:

equalizing the digital signal *prior to decoding the digital signal* in the trellis decoder; an equalizer...for producing an equalized signal *for coupling into the trellis decoder* (emphasis Examiner's).

The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims.

More exactly, in Fig. 6, note that the equalizing takes place *inside* the trellis decoder, *not prior to it*. Also, note that the equalizer and the trellis decoder are part of the same component, so that the equalized signal is *coupled out of* the trellis decoder. Accordingly, it is unclear how the application enables any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention with this limitation without undue experimentation.

10. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

11. **Claims 32 and 37** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In particular, note the following limitations:

(claim 32) an analog signal to optical converter that converts the analog signal to an optical *level* for coupling into an optical channel (emphasis Examiner's); and

(claim 37) the analog signal to optical *level* converter (emphasis Examiner's).

Examiner respectfully notes that, typically, *signals* are coupled into optical channels, not *levels*.

Optical channels usually carry signals, which are tangible physical phenomena. An optical level

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is not such a tangible physical phenomenon but rather a logical value. Without undue experimentation, one of ordinary skill in the art would find it difficult to couple an optical level, a logical value, into an optical channel, a physical medium. Also, Applicant's specification uses the term "signal,"

"The output of the laser 211, modulated by the analog representation of the multilevel symbols, is coupled into the optical channel 213. The optical channel 213 transmits the intensity modulated laser *signal* to an optical-to-electrical converter 215. The optical-to-electrical converter 215 accepts the optical *signal* from the channel 213 and converts it back to an intensity modulated series of electrical signals" (p. 4, l. 18-22, emphasis Examiner's).

In view of these issues, claims 32 and 37 are indefinite for failing to point out and distinctly claim the subject matter which applicant regards as the invention.

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. **Claims 1-2, 4, 7-9, 11, 13, 15, 18-20, 22-30, 32-33, 35, 37-40, 42-44, 46-59, 61-63, 65-66, 68, 70-73, and 75-80** are rejected under 35 U.S.C. 103(a) as being unpatentable over Ling et al. (International Application No. WO 98/39871, hereinafter "Ling") in view of the Uyematsu et al. ("Trellis coded modulation for multilevel photon communication systems," hereinafter "Uyematsu").

Regarding claim 1, Ling discloses:

A method comprising:

encoding (Fig. 3, portion before DAC 326) information via a trellis encoder to produce digital multilevel symbols;

converting (DAC 326) the digital multilevel symbols into analog multilevel symbols; and

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transmitting the analog multilevel symbols (output of DAC 326)

Ling does not expressly disclose:

transmitting the analog multilevel symbols *over an optical channel*.

However, the method of Ling is a trellis coded modulation (TCM) scheme, and Uyematsu teaches that applying TCM to optical communication systems is known in the art (Uyematsu, p. 582, col. 1, last paragraph). At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to apply the method of Ling to an optical communication system to transmit the analog multilevel symbols over an optical channel. One of ordinary skill in the art would have been motivated to do this since TCM is attractive in optical communication systems. That is, TCM can help relieve bandwidth limits imposed on an optical system by the optical system's electrical parts (Uyematsu, p. 582, col. 1, last paragraph). Also, it is well known that optical channels, such as optical fiber, offer benefits over other types of channels, such as electrical channels. Some well-known benefits of optical fiber are low loss and lower susceptibility to electromagnetic interference.

Regarding claim 2, Ling in view of Uyematsu discloses:

The method of claim 1 further comprising equalizing the digital multilevel symbols to compensate for characteristics of the optical channel (p. 3, l. 17-28).

Regarding claim 4, Ling in view of Uyematsu discloses:

The method of claim 2 wherein equalizing the analog multilevel symbols comprises precoding the digital multilevel symbols using a Tomlinson Harashima precoder (Tomlinson/Harashima precoding 324).

Regarding claim 7, Ling in view of Uyematsu discloses:

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The method of claim 1 wherein transmitting the analog multilevel symbols over an optical channel comprises modulating the intensity of a light source according to the level of the analog multilevel symbols (Uyematsu, "intensity modulator," p. 582, middle of col. 2).

Regarding claim 8, Ling in view of Uyematsu discloses:

The method of claim 1 wherein transmitting the analog multilevel symbols over an optical channel comprises modulating laser intensity according to a level of the analog multilevel symbols (Uyematsu, "intensity modulator," p. 582, middle of col. 2).

Regarding claim 9, Ling in view of Uyematsu discloses:

A method as in claim 2 wherein equalizing the digital multilevel symbols to compensate for the laser and channel characteristics comprises:

characterizing the channel (i.e. channel responses on p. 2, l. 31-35); and

applying an inverse characterization of the channel to the digital multilevel symbols (i.e. filter coefficients on p. 3, l. 17-22).

Regarding claim 11, claim 11 is a method claim that corresponds largely to the method claim 1. Therefore, the recited steps in method claim 1 read on the corresponding steps in method claim 11. Claim 11 also includes limitations absent from claim 1. Ling in view of Uyematsu does not expressly disclose these limitations:

accepting information from a plurality of sources;

a *plurality of* trellis encoders, digital multilevel symbols, analog multilevel signals; and

transmitting the analog multilevel signal by time division multiplexing the plurality of analog multilevel signals onto an optical channel.

However, Examiner takes Official Notice that these limitations are all part of an extremely well known practice of transmitting a time division multiplexed signal. At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to implement these limitations in the method of Ling in view of Uyematsu. One of ordinary skill in

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the art would have been motivated to do this since transmitting a time division multiplexed signal is a common way to transmit multiple channels of data across a single optical communication line (fiber), thus increasing the number of users without requiring the installation of additional optical communication lines (fibers).

Regarding claims 13, 15, and 18-20, claims 13, 15, 18, 19, and 20 are method claims that correspond to method claims 2, 4, 7, 8, and 9, respectively. Therefore, the recited steps in method claims 2, 4, and 7-9 read on the corresponding steps in method claims 13, 15, and 18-20.

Regarding claims 22-23, Examiner takes Official Notice that each of these claims discloses known ways to implement the extremely well known practice of transmitting a time division multiplexed signal. Claim 22 discloses a way using a *single* analog to digital converter. Claim 23 discloses a way using a *plurality* of digital to analog converters. At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to implement these various ways in the method of Ling in view of Uyematsu. One of ordinary skill in the art would have been motivated to do this since each offers design flexibility for the system of Ling in view of Uyematsu.

Regarding claim 24, Ling in view of Uyematsu discloses:

A method of receiving data from an optical channel, the method comprising:
accepting a multilevel optical signal from the channel into an optical to electrical converter (Uyematsu, "photo counting receiver," p. 582, middle of col. 2);
converting the multilevel signal into an analog electrical signal;
converting the analog electrical signal into a digital signal (Ling, ADC 360 in Fig. 3); and
decoding the digital signal in a trellis decoder (Ling, trellis decoder 366).

Regarding claim 25, Ling in view of Uyematsu discloses:

The method of claim 24 further comprising equalizing the digital signal prior to (FFE 362 or DFE 380) decoding the digital signal in the trellis decoder.

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Regarding claim 26, Ling in view of Uyematsu discloses:

The method of claim 25 wherein equalizing the digital signal comprises applying a decision feedback equalization (DFE 380) to the digital signal.

Regarding claim 27, Ling in view of Uyematsu does not expressly disclose:

A method as in claim 24 wherein converting the analog electrical signal to a digital signal comprises:

successively sampling the analog electrical signal; and
converting the *successive samplings* into a plurality of *parallel* digital values.

However, Examiner takes Official Notice that these limitations are all part of an extremely well known practice of receiving a time division multiplexed signal, in particular the successive sampling and parallel teachings. At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to implement these limitations in the method of Ling in view of Uyematsu. One of ordinary skill in the art would have been motivated to do this since receiving a time division multiplexed signal is a common way to receive multiple channels of data across a single optical communication line (fiber), thus increasing the number of users without requiring the installation of additional optical communication lines (fibers).

Regarding claim 28, Ling in view of Uyematsu discloses:

A method of signaling over an optical channel, the method comprising:
accepting data from a source (reception of data in 310 in Fig. 3);
trellis encoding the data (Fig. 3, portion before DAC 326);
coupling the encoded data into an optical channel (Uyematsu, "intensity modulator," p. 582, middle of col. 2);
conveying the data over the optical channel;
accepting data from the optical channel (Uyematsu, "intensity modulator," p. 582, middle of col. 2);

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decoding the data accepted from the optical channel (receiver 312); and
providing the decoded data to an interface (output of receiver 312).

Regarding claim 29, Ling in view of Uyematsu discloses:

A method as in claim 28 further comprising:

equalizing the data after trellis encoding the data (Fig. 3, Tomlinson/Harashima precoding 324).

Regarding claim 30, Ling in view of Uyematsu discloses:

A method as in claim 29 wherein equalizing the data comprises applying a Tomlinson-Harashima precoding to the data (Fig. 3, Tomlinson/Harashima precoding 324).

Regarding claims 32-33, 35, and 37, claims 32, 33, 35, and 37 are apparatus claims that correspond to method claims 1, 2, 4, and 8, respectively. Therefore, the recited steps in method claims 1-2, 4, and 8 read on the corresponding means in apparatus claims 32-33, 35, and 37. Claims 32-33, 35, and 37 also include limitations absent from claims 1-2, 4, and 8. Ling in view of Uyematsu discloses these limitations:

an analog signal to optical converter that converts the analog signal to an optical level for coupling into an optical channel (Uyematsu, “intensity modulator,” p. 582, middle of col. 2).

Regarding claims 38-40 and 43-44, claims 38, 39, 40, 43, and 44 are apparatus claims that correspond to method claims 11, 13, 15, 13, and 15, respectively. Therefore, the recited steps in method claims 11, 13, and 15 read on the corresponding means in apparatus claims 38-40 and 43-44. Claims 38-40 and 43-44 also include limitations absent from claims 11, 13, and 15. Ling in view of Uyematsu discloses these limitations:

an optical source that receives the plurality of analog multilevel signals and produces a light output (Uyematsu, “intensity modulator” and corresponding light source for the modulator, p. 582, middle of col. 2) for driving an optical channel.

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Regarding claim 42, claim 42 is an apparatus claim that corresponds largely to the method claim 11. Therefore, the recited steps in method claim 11 read on the corresponding means in apparatus claim 42. Claim 42 also includes limitations absent from claim 11. These limitations are:

a digital to analog converter that *sequentially* accepts the plurality of digital multilevel signals and produces a plurality of *sequential* analog multilevel signals.

However, Examiner notes that the treatment of claim 11 incorporates a time division multiplexed signal. At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to include these *sequential* limitations in the apparatus of Ling in view of Uyematsu. One of ordinary skill in the art would have been motivated to do this since time division multiplexing requires *sequential* treatment of a plurality of channels.

Regarding claims 46-48, claims 46, 47, and 48 are apparatus claims that correspond to method claims 24, 25, and 26, respectively. Therefore, the recited steps in method claims 24-26 read on the corresponding means in apparatus claims 46-48.

Regarding claim 49, claim 49 is method claim that corresponds to method claim 23. Therefore, the recited steps in method claim 23 read on the corresponding steps in method claim 49.

Regarding claims 50-54, claims 50, 51, 52, 53, and 54 are method claims that correspond to method claims 24, 25, 26, 24, and 23, respectively. Therefore, the recited steps in method claims 23-26 read on the corresponding steps in method claims 50-54.

Regarding claim 55, claim 55 is a method claim that corresponds to method claim 54. Therefore, the recited steps in method claim 54 read on the corresponding steps in method claim 54.

Regarding claim 56, claim 56 is a method claim that corresponds to method claim 28. Therefore, the recited steps in method claim 28 read on the corresponding steps in method claim 28.

Regarding claims 57-59, claims 57, 58, and 59 are method claims that correspond to method claims 28, 29, and 30, respectively. Therefore, the recited steps in method claims 28-30 read on the corresponding steps in method claims 57-59.

Regarding claims 61-63, claims 61, 62, and 63 are method claims that correspond to method claims 28, 29, and 30, respectively. Therefore, the recited steps in method claims 28-30 read on the corresponding means in apparatus claims 61-63. Claims 61-63 also include limitations absent from claims 28-30. Ling in view of Uyematsu discloses these limitations:

converting the data accepted from the optical channel to digital data (ADC 360 in Fig. 3);
and

decoding the digital data accepted from the optical channel (portion after ADC 360).

Regarding claims 65-66, 68, and 70, claims 65, 66, 68, and 70 are method claims that correspond to method claims 32, 33, 35, and 37, respectively. Therefore, the recited steps in method claims 32-33, 35, and 37 read on the corresponding steps in method claims 65-66, 68, and 70.

Regarding claims 71-72, claims 71 and 72 are method claims that correspond to apparatus claims 38 and 39, respectively. Therefore, the recited means in apparatus claims 38-39 read on the corresponding means in apparatus claims 71-72.

Regarding claim 73, claim 73 is a method claim that corresponds largely to the apparatus claim 40. Therefore, the recited means in apparatus claim 40 read on the corresponding steps in method claim 73. Claim 73 also includes limitations absent from claim 40. These limitations are:

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wherein the plurality of equalizers comprise a *plurality* of Tomlinson-Harashima precoders;

However, Examiner notes that the treatment of claim 40 (through parent claim 38, further through relation of claim 38 to independent claim 11) incorporates a time division multiplexed signal. At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to include these *plurality* limitations in the method of Ling in view of Uyematsu. One of ordinary skill in the art would have been motivated to do this since time division multiplexing requires treatment of a *plurality* of channels. That is, by doing so, one could apply the benefits of Tomlinson-Harashima precoding (i.e. improved removal of intersymbol (ISI) interference, p. 3, l. 6 – p. 4, l. 25) to each of the channels in the time-division multiplexed signal.

Regarding claims 75-79, claims 75, 76, 77, 78, and 79 are apparatus claims that correspond to apparatus claims 46, 47, 48, 46, and 48, respectively. Therefore, the recited means in apparatus claims 46-48 read on the corresponding means in apparatus claims 75-79.

Regarding claim 80, claim 80 is method claim that corresponds to method claim 24. Therefore, the recited steps in method claim 24 read on the corresponding steps in method claim 80.

14. **Claims 5, 16, 31, 36, 41, 45, 60, 64, 69, and 74** are rejected under 35 U.S.C. 103(a) as being unpatentable over Ling in view of Uyematsu as applied to claims 2, 13, 30, 32, 39, 43, 59, 63, 66, and 72 above, and further in view of Fischer et al. ("Dynamics limited precoding, shaping, and blind equalization for fast digital transmission over twisted pair lines," hereinafter "Fischer").

Regarding claim 5, Ling in view of Uyematsu does not expressly disclose:

The method of claim 2 wherein the equalizing the digital multilevel symbols comprises precoding the digital multilevel symbols using a dynamic limiting precoder.

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However, dynamics limiting precoders are known in the art. Fischer teaches such precoders (Fischer, Fig. 4). At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to improve the Tomlinson Harashima precoder of Ling in view of Uyematsu by implementing the dynamics limiting precoder teachings of Fischer. One of ordinary skill in the art would have been motivated to do this since dynamics limiting precoding is a straightforward extension of Tomlinson Harashima precoding that provides the advantage of a lower dynamic range of the receiver input signal (Fischer, p. 1626, col. 1, last paragraph). When the dynamic range becomes very large, implementation of the system becomes complicated (Fischer, p. 1624, middle of col. 2).

Regarding claim 16, claim 16 is a method claim that corresponds to method claim 5. Therefore, the recited steps in method claim 5 read on the corresponding steps in method claim 16.

Regarding claim 31, claim 31 introduces a limitation that is addressed by Fischer (see treatment of claim 5 above). Similarly, Fischer is applied here to address the same limitation.

Regarding claim 36, claim 36 is an apparatus claim that corresponds to method claim 5. Therefore, the recited steps in method claim 5 read on the corresponding means in apparatus claim 36.

Regarding claims 41 and 45, claims 41 and 45 are apparatus claims that both correspond to method claim 16. Therefore, the recited steps in method claim 16 read on the corresponding means in apparatus claims 41 and 45.

Regarding claim 60, claim 60 is a method claim that corresponds to method claim 31. Therefore, the recited steps in method claim 31 read on the corresponding steps in method claim 60.

Regarding claim 64, claim 64 is a method claim that corresponds to method claim 31. Therefore, the recited steps in method claim 31 read on the corresponding steps in method claim 64.

Regarding claim 69, claim 69 is an apparatus claim that corresponds to method claim 36. Therefore, the recited steps in method claim 36 read on the corresponding means in apparatus claim 69.

Regarding claim 74, claim 74 is a method claim that corresponds largely to the apparatus claim 41. Therefore, the recited means in apparatus claim 41 read on the corresponding steps in method claim 74. Claim 74 also includes limitations absent from claim 40. These limitations are:

wherein the plurality of equalizers comprise a *plurality* of dynamic limiting precoders;

However, Examiner notes that the treatment of claim 41 (through parent claim 38, further through relation of claim 38 to independent claim 11) incorporates a time division multiplexed signal. At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to include these *plurality* limitations in the method of Ling in view of Uyematsu. One of ordinary skill in the art would have been motivated to do this since time division multiplexing requires treatment of a *plurality* of channels. That is, by doing so, one could apply the benefits of dynamic limiting precoding (Fischer, i.e. a lower dynamic range of the receiver input signal, p. 1626, col. 1, last paragraph) to each of the channels in the time-division multiplexed signal.

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Agazzi et al. is cited to show related methods and apparatuses by Applicant and others.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Kim whose telephone number is 571-272-3033. The examiner can normally be reached on Mon.-Fri. 9 AM to 5 PM (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on 571-272-3022. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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